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This paper presents the findings of a survey of fifteen undergraduates from three public institutions in North Carolina on their use of cell phones as a tool for instruction, learning, and collaboration. The survey was conducted to better understand the state of students' attitudes toward using cell phones within the context of the educational realm. Participants in the survey were selected as part of the Bot 2.0 project which seeks to promote the field of Botany to traditionally underrepresented populations using mobile phones, social networks, and collaborative web services. The results indicate a lack of use of cell phones by undergraduates within an educational setting while showing a heavy use within the social realm. A majority of the students studied did not regard cell phones as a good tool for completing homework or for accessing instructional materials. All but two of the students (87%) were in agreement about cell phones as a tool for collaboration with classmates.

Headings:

Mobile phones

Undergraduate students

Teaching-Aids and devices

A SURVEY OF UNDERGRADUATES' USE AND ATTITUDES OF CELL PHONES FOR INSTRUCTION, LEARNING AND COLLABORATION

by
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Approved by

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Jane Greenberg

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1. Introduction

Today's educators are faced with new challenges as they struggle to teach students that are immersed in the always on, always available, and content rich digital environments that characterizes the current college campus. Digital educational tools from the adoption of PowerPoint presentations in the classroom to course management software are seen in every discipline. Nearly every modern classroom has wireless Internet accessibility and is set up with a computer projector. More recently, students' laptops have become as ubiquitous as spiral bound notebooks once were. We are experiencing the next wave of technological progress as cell phones are quickly being adopted by students (Horrigan, 2009). Students are bringing new mobile technology, such as the iPhone and the Blackberry into the classroom. These devices have capabilities more powerful than the personal computers of just a few years ago and offer exciting new opportunities and new challenges for educators as they learn how to use them in instruction. Mobile technology can help extend the classroom out into the world by bringing teaching tools into new contexts.

Students are starting to arrive at college very familiar with how to play games, listen to music, and text their friends using the latest cell phones. As mobile platforms become the norm on a social level, they are likely to become more widely used on an educational level. Educators and creators of new mobile educational tools can be more effective in their learning goals with a better understanding of students' attitudes toward

using their cell phones within the physical and virtual classroom. This research seeks to better understand how students currently use cell phones and to gauge students' attitudes towards potential use of cell phones in the educational realm. This paper presents the findings of a survey of undergraduates on their use of cell phones as a tool for instruction, learning, and collaboration. The survey was conducted as part of the NSF-funded Bot 2.0 project which seeks to promote the field of Botany to traditionally underrepresented populations using mobile phones, social networks, and collaborative web services.

2. Literature and Background

2.1 Increase in cell phone adoption rate

Cell phones have quickly become the main platform for communication by people worldwide. The past decade has seen a ten fold increase in the adoption rate of phones with a worldwide subscriber rate of 6 subscriptions for every 10 inhabitants on the planet. The United States currently ranks 17th in usage of cell phones with a 83.5% subscriber rate according to the recent International Telecommunications Union (ITU) report (2009). The ITU also found that there are more individual cell phone subscriptions than there are households with a computer (70.2%) and Internet connections in the United States (61.7%).

2.2 Increase in technology capabilities

Cell phones are not simply about voice communication anymore and are increasingly being used for other tasks. Cell phones are being used to not only talk with friends and family but to share photographs, videos, and text messages sent from their phones. In addition to owning cell phones at a higher rate, young adults use the extended features of cell phones at a higher rate. The Pew Internet & American Life Project Survey found that users in the 18-29 year old age range are twice as likely to use text messaging, play games, access the internet, record and watch videos, play music, and access maps on their cell phone than those in the 30-49 year old age range. Young adults

were as much as five times more likely to use these advanced features than the those in the 50-64 age range (Horrigan, 2009, p. 5).

Cell phones have become sophisticated computing platforms. The newest devices known as smartphones can be used to access the Internet and to run applications. These devices are not just smaller versions of traditional computers; they are changing the nature of computing interaction. Additional capabilities such as GPS and video recording mean that these devices can serve as sophisticated tools in research and are being used or considered as a primary data collection device in research from everything from epidemiology (Datadyne.org, 2009) to the social sciences (Raento, Oulasvirta & Eagle, 2009).

College aged students are carrying smartphones in larger and larger numbers. Although data is limited on the overall number of smartphones in use by students, these phones currently represent 13 percent of the total cell phone market (Meford, 2008). A particular smartphone, the iPhone, is highly coveted by younger people with a recent survey finding that 22 percent of teenagers expected they would own an iPhone in the next 6 months (Chen, 2008). The market research company Rubicon Consulting, Inc. (2008) found that half of the users of the iPhone are under age 30 and 15% of the users of the iPhone are students. Rubicon also found that people tend to carry their iPhone in lieu of a notebook computer.

2.3 Cell Phones in education

Teens are shifting away from using the computer for "traditional" communication activities such as email, preferring instead to use other methods such as text messaging on a cell phone (Lenhart, Madden, Macgill & Smith, 2007). The prevalence of text messaging and other non-voice usage of cell phone by undergraduate students can be seen by simply walking across a college campus, standing in line at the cafeteria, sitting in on a class, or visiting the library. Universities are recognizing this trend and, just in the past year, schools have received attention for their large scale attempts to enter the realm of mobile education. In 2008 Abilene Christian University offered an iPhone or an iPod touch to each incoming student (Brown & Metcalf, 2008). The university sees the new technology as a platform to drive teaching innovation. ACU ("Our Vision", 2009) indicates:

> The [iPhone program] is built upon the theory that humans learn best when they are in community—collaborating with others in a learning environment without boundaries. A technological solution that aims at increased learning must enhance communication and convergence.

The school is realizing this vision through the use of delivery of learning materials directly to the iPhones in the form of podcasts, PDFs, and custom software applications. These applications include classroom response systems, file storage, and direct access to student and course management systems ("Our Progress", 2009). Other schools such as Duke University and Stanford University are creating similar programs with integrated mobile tool for iPhones and Blackberries that focus on informational materials such as podcasts, YouTube videos, bus availability, and campus maps (Shieh, 2009).

2.4 Individual studies

There are a number of multiple small-scale studies on the use of portable computing devices in individualized learning contexts. The rise of research addressing this area predates the current smartphone technology and has its origins with personal data assistants (PDA) which were more prevalent in the mid 1990s to early 2000s.

The early educational pilot studies involved introducing students to these new types of technology without the students having prior experience using the tools. A pilot study by National Council for Educational Technology in the United Kingdom provided handheld "pocketbook" computers (essentially PDAs) to a class of 15 and 16 year-olds and studied the students' feelings about the new technology and examined the learning factors involved in using these tools (Fung, Hennessy, & O'Shea, 1998). The researchers found in their results that the technology was a motivator to the students to complete materials and the use of the computers contributed to the overall learning goals. Waycott & Kukulska-Hulme (2004) found that although the student motivational factors were high, there were practical issues with mobile devices such as small text size, difficult navigation, and issues entering data into the PDAs.

A large portion of studies on the educational use of PDAs focus on specialized learning environments with a particular emphasis of studies in the areas of health education (Johnston, Janice M et al., 2004). Kho, Henderson, Dressler, and Kripalani (2006) found in a meta analysis of 67 PDA studies focused on medical education that medical students were early adopters of PDA and smartphone technology with 70% of students choosing to use a PDA device. These prior studies also found that the most

popular use of the PDA was as a receiver and viewer of course materials. Researchers found only one of the 67 studies that examined educational outcomes. Leung et. al (2003) showed that learning outcomes increased with the use of PDAs but also indicated technical issues that students have when using these tools. The high rate use of PDAs by medical students mimicked the actual practice of doctors--PDAs are widely used in medicine. However, the same is not true of general college students where they will not necessarily be using PDAs but they will and are carrying their cell phones and smartphones.

More recently studies have focused on using the devices that students already have in their pockets and not just an additional computing tool that is unfamiliar to them. Thorton and Houser (2004) conducted research in the use of cell phones for language learning in Japan. The 333 students studied were found to be heavy users of text messaging using the phone to send messages an average of 194 times a week and to receive messages 82.8 times a week. In comparison, the students reported using the phone as a method of voice communication (a phone call) only 6.6. times a week. As part of the study, students received periodic English vocabulary lessons via mobile email and were encouraged to use these emails as a part of their studies. These students were compared to groups that were encouraged to use a traditional paper study method or to just read the material on a laptop or desktop computer. The mobile email group who studied using their phones were happier with this method, found to have learned more, and vast majority (71%) felt that the use of cell phones is a valuable learning method.

Students in the Mottiwalla (2007) study also reported that students found phones to be useful in an online learning environment called mobile learning service (MLS) created by the researchers. These students, in a senior year elective course, were provided materials through mobile optimized web pages accessed through their own phones or through a cell phone simulator on a computer (for those who didn't have web capable phones). The study found that 65% of the subjects reported a 4.20 average (on a scale where 5= strongly agree and 1=strongly disagree) to the statement "MLS is an effective learning aid or assistant for students" The students studied reported having a neutral response (2.68) as to the ease of use of the system. This study's reliance on the simulator rather than using tools that students currently own could have been an issue affecting ease of use.

Another approach to the use of cell phones in the classroom is to keep the use of the phones to the lowest complexity level and to only use Short Messaging Service (SMS) which is used to send text messages or Multi-media Messaging Services (MMS) which is used to send photographs from phones. Some of these projects have used cell phones within the classroom to gain feedback and provide an interactive tool for students (Markett, Sánchez, Weber & Tangney, 2006). Phones have also been used as a way to respond to experiments or games within a class via SMS. Cheung (2008) created a way for economics students to participate in a game theory experiment during class using their cell phones. These types of projects show how cell phones can be useful not only for student interaction but also for collecting data.

Now that most mobile phones include cameras, educators can explore ways of using images as part of the learning experience. An example of such an activity is shown by a pilot study by Moura & Carvalho (2008). The reseearchers had 10 secondary students in Portugal use their own phones to take photographs of monuments within the city of Braga as part of a field study. Students then emailed the photographs to Flickr where they were annotated by other students working at desktop computer. The students studied reported agreement by a rate of 70% to the question, "I like to be able to send a picture from my phone to the web via Mobile Flickr." They had a rate of 60% agreement and 40% uncertainty to the question, "Using the phone to conduct this activity led me to the study of Baroque." All of the students studied cited that emailing photos using the phone had a high cost.

Studies of smartphones in education are more limited, perhaps because only a minority of users own them. However, some researchers such as Milrad & Sikol (2007) have conducted studies in which they provide a smartphone to the participants in order to get data in this area. In the "MUSIS Project" the researchers created a delivery system that included lectures, web pages, and communication tools for a series of classes at two colleges in Sweden. They found that integrating the smartphone tools into the course content. In one course where the content was integrated, 40% of the students reported that the educational mobile services were "very useful" and 27% reported they were "useful." A course where the educational mobile services were offered but not integrated, a majority of students found the the service only "fairly useful" (41%) or "not useful" (18%). The researchers also asked a class about the usefulness of the phones for

collaboration and found a majority (64%) found the phones were either “helpful” or “very helpful” in communicating with their classmates. In the area of instructor feedback, the researchers found only 29% found the mobile tool “helpful” or “very helpful.”

The review of the literature gives an indication of the growth of the use of phones by young adults as well as a variety of potential applications of the technology. There is a need for additional studies to explore and demonstrate the new learning potentials cell phones can provide by bringing instruction out into “the field” to enable new ways and forms of data gathering and collaboration for learning. In addition the literature doesn’t generally address the needs of minority populations. The NSF-funded Bot 2.0 program provides a chance to study these aspects of mobile learning. Bot 2.0 uses mobile phones as a tool alongside social networks and collaborative web services to enable an engaged Botany learning experience for traditionally underrepresented populations. A look at the participants of Bot 2.0 can provide perspective on future opportunities and obstacles.

3. Research Goal

The goal of this research is to examine both the state of cell phone use in the educational realm as well as the state of students' attitudes and current use toward using cell phones as a tool in an educational manner. Through an examination of students' current attitudes toward the use of cell phones as well as usage rates of the phones within the multiple contexts--with friends, family and instructors--we can better understand the prevailing perspectives of students using cell phones within a learning environment. Educators can be more effective with the use of mobile tools if they better understand students' current acceptance of the educational realm moving into what has been a traditionally social realm. This research, conducted as an element of the NSF-funded Bot 2.0 project, can also aid in designing appropriate learning tools for the audience.

4. Methodology

The method used for this study was a survey completed by participants of the Bot 2.0 project at the University of North Carolina at Chapel Hill. This ongoing project is conducted by members of the North Carolina Botanical Garden, School of Information and Library Science at the University of North Carolina at Chapel Hill, and the Renaissance Computing Institute.

4.1 General description

In order to gather information about student attitudes and current use of cell phones a survey was created. The survey included questions on cell phone usage for personal and academic settings as well as other methods of communication for comparison purposes. Surveys were completed by participants in Bot 2.0. The survey was conducted at the start of the project prior to any learning activities. The survey questions on cell phone usage and attitudes were a subset of a longer survey created for multiple additional research areas. All of the survey questions were created in a collaborative process with members of the Bot 2.0 research team. A separate follow-up survey was completed that contained identical questions to the initial survey. The findings of the second survey are not reflected in these results.

4.2 Participants

The participants in the survey were subject to the requirements of the Bot 2.0 project which included stipulations that they were over the age of 18, currently enrolled in an undergraduate program in North Carolina, had little or no prior knowledge of Botany, and were able and willing to participate in the summer BotCamp program consisting of 5 weeks of virtual classroom sessions and 3 days of on-campus sessions. Participants were recruited from three campuses in North Carolina including North Carolina Agricultural & Technical State University (North Carolina A&T), North Carolina State University, and Alamance Community College. Although the focus of the project was on minority and traditionally underrepresented students, no exclusions of participants in the program based on race or gender were made. However, the recruitment process focused on programs that involve primarily women and minorities and the sample reflects this effort.

Recruitment tools were created including an informational web site and flyer. The researcher met with an undergraduate class at North Carolina A&T, the director of the Women in Science and Engineering (WISE) program at North Carolina State University, and with faculty members and librarians at Alamance Community college to promote the program. An honorarium of $200 and a stipend of $50 were offered to participants who completed both the surveys and the BotCamp program.

4.3 Procedures

After the students were recruited, they were instructed to take the survey prior to engaging in any of the learning activities as part of the BotCamp program. The survey

was entered and hosted on a web-based survey platform (SurveyMonkey.com). An email was sent to the subjects and a link to the survey was provided with a request that the survey be completed on their own over the course of several weeks. Prior to taking the survey, the students agreed to an electronic letter of implied consent as a research subject following requirements of the University of North Carolina's Institutional Review Board.

4.4 Survey Description

The full survey consisted of a total of 147 questions which included a section of 45 questions selected for the portion related to this study of cell phone usage as well as a demographic section and questions related to botanical learning, metadata literacy, and social networks. The survey was not anonymized and students provided their names as well as other identifying details on the survey but this information is not revealed in public distribution of the results.

The survey portion on cell phone and other technology usage consisted of 50 questions on several areas. These areas included binary questions on technology ownership and use such as:

> *Do you own a cell phone?*
> *Do you use your cell phone to access web sites?*
> *Have you ever used a phone to access instructional materials?*

Questions about frequency of use of various mediums of communication technologies were asked. These questions were asked under three different contexts including friends, family, and school instructors. A typical question of this type was:

> *On a scale of 1 to 5 where 1=never and 5=every day, how do you communicate with your school instructors?*

Participants answered each question for the following communication methods:

- e-mail
- landline phone
- cell phone
- in person
- text message
- instant messaging
- messaging through Facebook/MySpace

In order to elucidate information about the subject's attitudes about using cell phones for instructional purposes and how those attitudes compare to using cell phones for other purposes, a series of questions using a Likert scale with seven categories was used. An example of these questions on attitude is:

> *For the following questions, please rate your level of agreement with the statement from 1 to 7 with 1 = "strongly disagree" to 7="strongly agree"*
> *A cell phone is how I generally collaborate with class peers*

Two of these questions addressed the same communication methods (e-mail, landline phone, etc.) as addressed above. In addition, one series of questions also using a Likert scale focused on the use of cell phones in different contexts including: accessing instructional materials, completing homework assignments, and communicating with classmates. An example of these questions is

> *For the following questions, please rate your level of agreement with the statement from 1 to 7 with 1 = "strongly disagree" to 7="strongly agree"*
> *Cell phone is a good way to access instruction assignments.*

In addition to these Likert scale questions about preferences on instructional materials, the survey included a direct question on which format they prefer out of the options of online, cell phone, or lecture/notes.

This research uses portions of the demographic section of the survey including gender, race and age. Other identifying sections are not included. Portions of the survey on social networking, botany knowledge, and metadata literacy are not included in these results.

5. Results

Nineteen students agreed to participate in the BotCamp program. Four students dropped out due to conflicts prior to the beginning of the BotCamp program. The survey was taken by 15 students and 14 students eventually participated in the full BotCamp program. Surveys were completed between July 10 and July 23, 2008.

The survey participants included 7 students from North Carolina Agricultural & Technical State University, 2 students from Alamance Community College, and 6 students from North Carolina State University. There were 11 female and 4 male participants and the group was approximately half self -identified as African-American/ black and the other half as Caucasian/white. The subjects were between 18 and 26 years old with an average age of 20.5.

All the subjects reported that they own a cell phone and all but one reported owning either a desktop or laptop computer. All but one subject had daily access to a computer and had used a course management software program like Blackboard. A majority (78%) reported using a cell phone to take photographs.

The survey found that cell phones were the most frequently used communication device among friends and family. Text messaging and social networks were a close second and third in frequency for communicating with friends. In-person and email were the most popular forms of communicating with instructors. All other methods of communicating with instructors were nearly never (never = 1) with the respondents

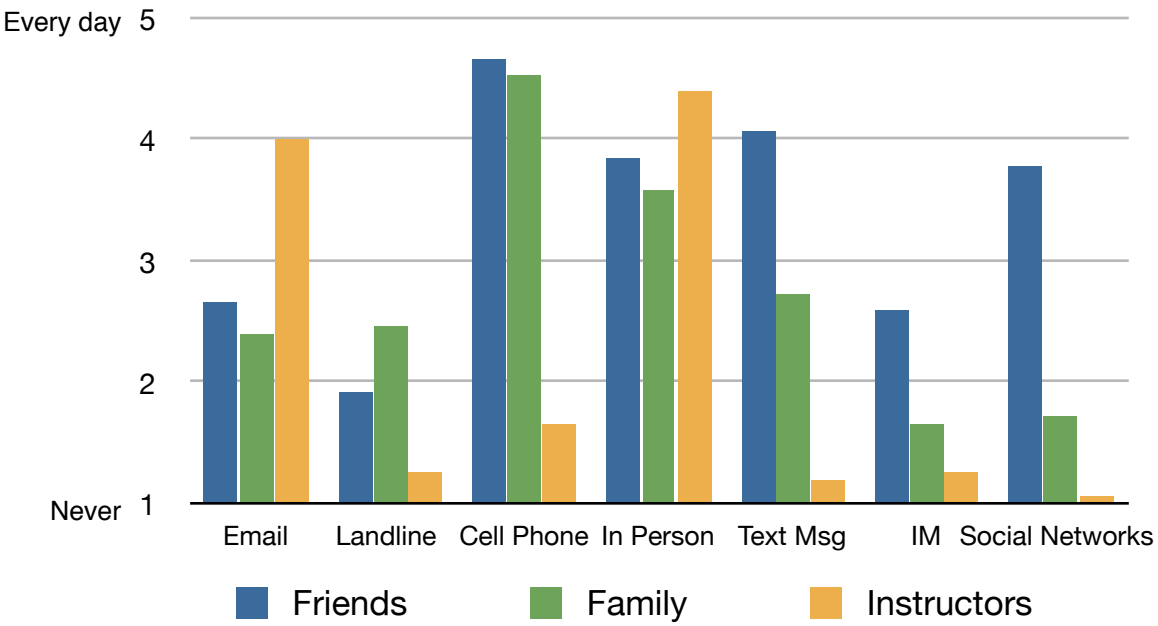

Figure 1: Frequency of communications with friends, family, and instructors using various mediums (mean of responses).

nearly in full agreement on social networks almost never used as shown with the standard deviation of .26.

The subjects spent a substantial amount of time using technology. They reported to be regular users of SMS text messaging with an average of a little more than 15

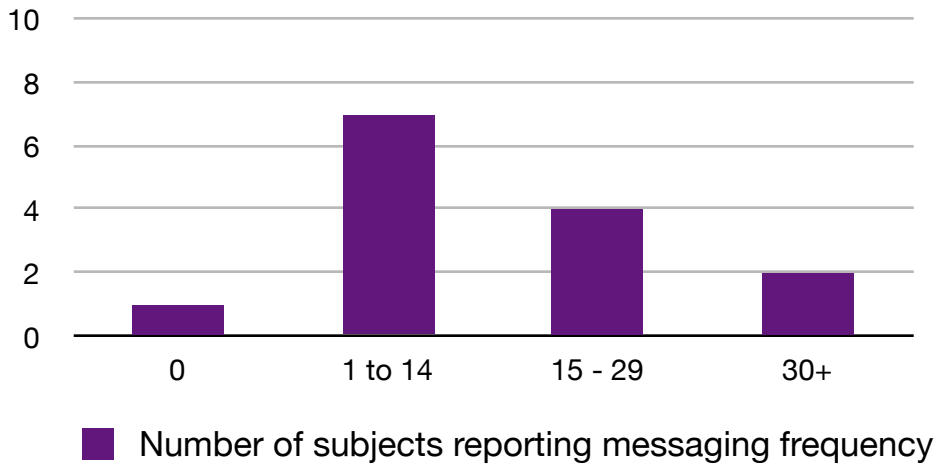

Figure 2: Subjects reporting of the number of SMS text messages sent on a daily basis (number of subjects responding).

messages sent and received per day. They also reported an average of 3.9 hours of daily desktop and/or laptop computer use.

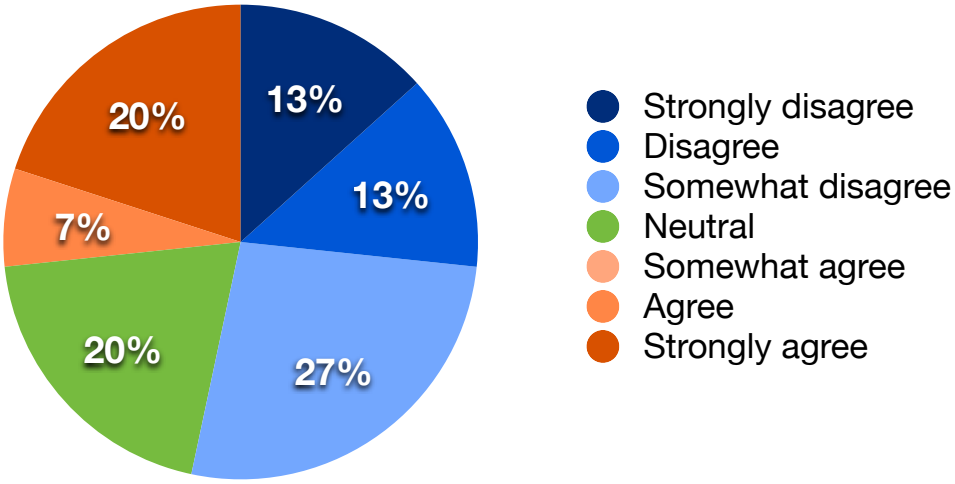

Figure 3: Level of agreement with the statement, "Cell phones are a good way to access instructional materials" (percentage of responses).

Students were not in complete agreement in their responses on the series of questions asking the subjects about their attitudes towards cell phone use within the context of learning environments. Most of these questions had standard deviations

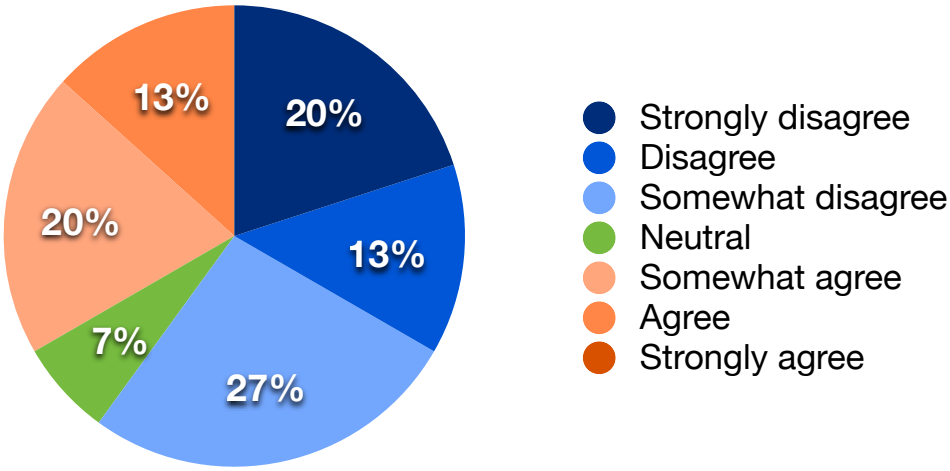

Figure 4: Level of agreement with the statement, "Cell phones are a good way to complete homework assignments" (percentage of responses).

greater than 2. About a third of the subjects responded that they strongly agreed or agreed with the statements “Cell phones are a good way to access instructional material” and “Cell phones are a good way to complete homework assignments”

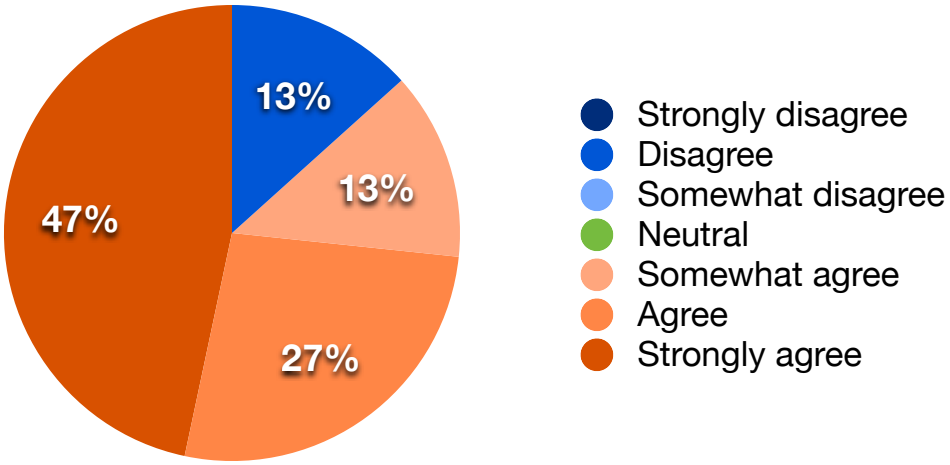

Figure 5: Level of agreement with the statement, “ Cell phones are a good way to communicate with classmates” (percentage of responses).

The response of subjects attitudes towards cell phone use within the context of classmates is vastly different than the attitudes toward use of phones in the context of homework or talking to their instructors. Only two subjects (N=15) disagreed with the statement, “Cell phones are a good way to communicate with classmates” and eleven of the subjects selected “agree” with the statement.

A majority of the subjects reported a preference for materials delivered in traditional manners. Two-thirds of the subjects preferred either textbooks or notes from attending lecture. One-third preferred materials online over textbooks and lecture notes. Subjects were also asked about their preferred methods of collaboration as well as their perceptions of the best ways to collaborate. There was general agreement about most methods with the exception of using landline phones and text messaging to collaborate.

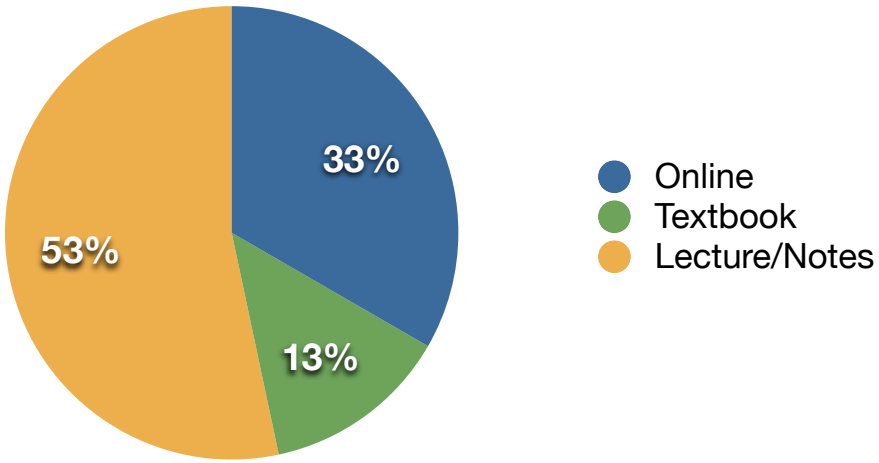

Figure 6: Instructional material preference (percentage of responses).

Landline phones received neutral response when the subjects asked if they were one of the "best ways to collaborate" but the subjects reported that they disagreed with the statement that using a landline phone "is how I generally collaborate." The subjects had slight agreement with the statement in terms of text messages as a form of

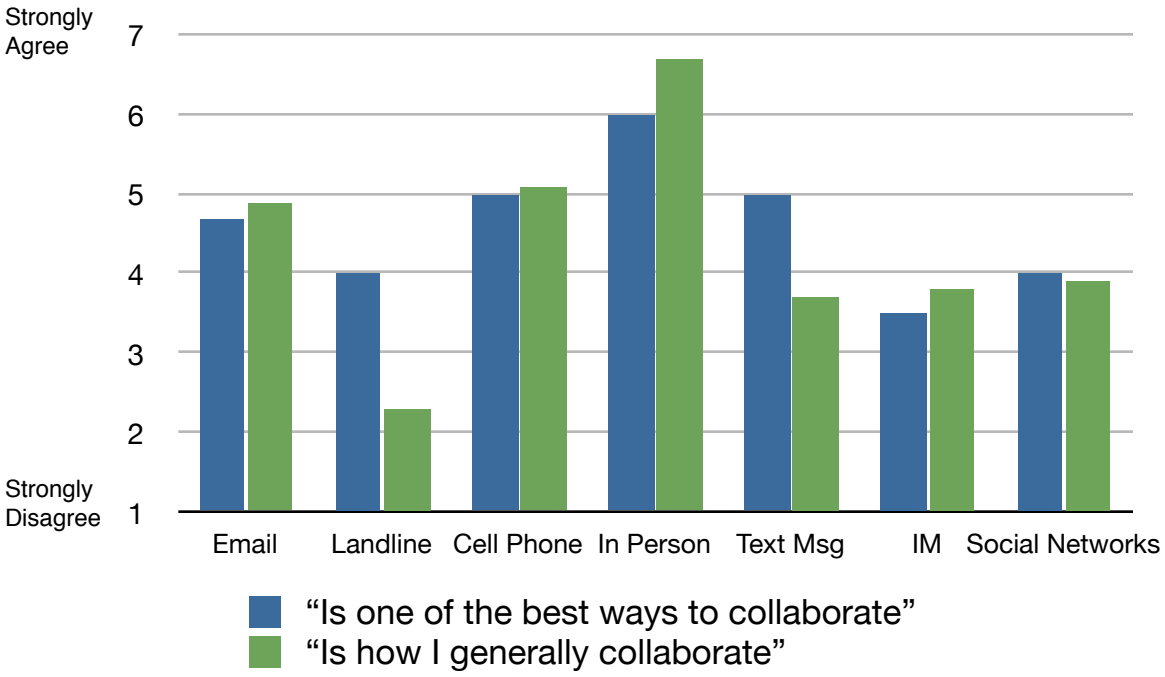

Figure 7: Collaboration attitudes (mean of responses).

collaboration but were, on average, neutral about text messaging as a form they use to collaborate. Instant messaging and the use of social networks generally received neutral or negative responses as a mode of collaboration either perceived or in practice.

6. Discussion

The results of the study confirms the findings of the recent Pew study (Kennedy, 2008) showing that students are heavy users of technology. All of the students were found to be using cell phones on a regular basis for calls and for text messaging and nearly all own a computer and are on the internet for a significant portion of the day. These results are not surprising given prior studies and the easily observable ubiquity of cell phones and computers on campus.

These students choose to use cell phones as the main way to stay in touch with their friends either using calls or text messages. Social networks are not far behind in preferences for keeping up with their friends. However, these students do not use cell phones, their main communications channel, to interact with their instructors nor do they see these tools as a good way to get access to instructional materials. The prevailing attitude indicating a lack of support towards using phones in an educational setting by a majority of the students indicates that there may be a barrier to introducing instructional tools within this realm. Students are definitely more inclined to approach their instructor in person or on email.

There are several possible reasons for the participants disagreement towards statements on educational cell phone use. It may be that students have not had an opportunity to think about using cell phones in this manner and therefore it is more of an unknown. Perhaps once students experience a situation where they are interacting with

their instructors and course materials on a regular basis, this attitude will improve. Previous research (Mottiwalla, 2007, Thorton & Houser, 2004) indicates that this is likely to happen.

Another possible reason that students may not support cell phones within class is that they may have tried to interact with instructors and course materials and had poor experiences in the past. Although this is a possible reason, it is less likely since there isn't much of a movement among most instructors to use and encourage the use of cell phones. However, the early impressions of these students should be taken into account as educators enter this medium.

It is interesting to note that in a focus group conducted by Hill Taylor as part of the Bot 2.0 project (not included in the scope of this data), this selection of students indicated a sensitivity toward pricing of their cell phone plans (2008). When they are using the extended capabilities, these particular students may be aware of the cost of using their phone to access the web (a capability that can cost as much as $30 a month in the case of the iPhone). It may be that students are reluctant because of these high costs. If there is additional cost related to the capabilities of cell phones that are used in education, there may be an additional barrier in place that needs to be overcome by students and teachers.

There was a higher percentage of agreement toward the statement about homework on the cell phone versus the statement on instructional materials. This is interesting given the realities and difficulties of entering material on cell phones versus

the relative ease of reading material on cell phones. Again, this may be due to the lack of experience students have had using a cell phone beyond the social realm.

There is room for optimism in these results in that there is a high recognition by this group that cell phones and text messaging are good a way to collaborate. In fact these are equal to (if not greater than) the use of email. The negative responses as to instructional materials, interacting with their instructors, and homework indicate that what they consider their sphere of collaboration does not include the instructor. This attitude matches similar attitudes in prior research (Milrad & Spikol, 2007) indicating that an active instructor role on mobile phones may not be as successful as a more passive role.

7. Further Study

This research focused on an initial survey given to students participating in the Bot 2.0 project. The follow-up survey is being analyzed to see if there is change in attitudes in the use of mobile phones for education by these participants. However, given the small role of mobile phones in relation to the longer BotCamp, it is likely that this data will not show much change for these factors. A better experiment to elucidate the possibility to change student attitudes would involve greater use of the cell phones to create materials, use materials, and to interact with both instructors and classmates.

As wealthier students are able to purchase and use the latest cell phones, there is also a need to better understand the possibilities this creating a tiered access to education. If education is going the way of mobile technology, then there will be barriers to those who can not afford the latest phones that are able to connect at the fastest speeds. Educators creating mobile learning platforms will need to understand what minimum amount of technology access can provide the greatest benefits.

There is a tremendous opportunity to conduct a more controlled study with the onset of the smartphone programs such as the one at Abilene Christian University where iPhones are provided to all students. When students all have the same phone and the same ability to get access, we can get a better sense of the underlying attitudes by eliminating the biases that can occur because of different technology being used or issues with service plan costs. The real promise of mobile education without walls can be

achieved as the barriers to access are removed and the true potential of mobile tools for collaboration and work out in the field for *all* students can be realized.

8. Data tables

Table 1

Question	Yes	No	*N*
Do you own a cell phone?	14	0	14
Do you use a cell phone to take photographs?	11	3	14
Do you use your cell phone to access web sites?	2	12	14
Do you own a desktop computer?	9	5	14
Do you own a laptop computer?	8	6	13
Do you have daily access to a computer?	13	1	14
Have you taken a class that uses use WebCT, Blackboard, or other type of course software?	14	1	15

Table 2

Question	Online	Textbook	Lecture/Notes	*N*
What is your preferred way to access course materials?	5	2	8	15

Table 3

Question	*M*	*SD*	*N*
Approximately how many hours do you use a computer per day?	3.9	3.1	14
Approximately how many text messages do send per day?	15	16	14
Approximately how many text messages do you receive per day?	15	15	14
How do you communicate with your friends? 1 = "Never" and 5 = "Every day"			
How do you communicate with your friends - e-mail?	2.7	1.0	15
How do you communicate with your friends – landline phone?	1.9	1.1	15
How do you communicate with your friends – cell phone?	4.7	0.62	15
How do you communicate with your friends – in person?	3.9	0.99	15
How do you communicate with your friends – text message?	4.1	1.2	15
How do you communicate with your friends – instant messenger?	3	2	15
How do you communicate with your friends – messages through Facebook/MySpace?	4	1.3	15
How do you communicate with your family? 1 = "Never" and 5 = "Every day"			
How do you communicate with your family - e-mail?	2	1.2	15
How do you communicate with your family – landline phone?	2.5	1	15
How do you communicate with your family – cell phone?	4.5	0.74	15
How do you communicate with your family – in person?	4	1.1	15

Table 3 continued

Question	*M*	*SD*	*N*
How do you communicate with your family – text message?	2.7	1.5	15
How do you communicate with your family – instant messenger?	1.7	1.0	15
How do you communicate with your family – messages through Facebook/MySpace?	1.7	1.2	15
How do you communicate with your school instructors? 1 = "Never" and 5 = "Every day"			
How do you communicate with your school instructors - e-mail?	4	0.76	15
How do you communicate with your school instructors – landline phone?	1.3	0.59	15
How do you communicate with your school instructors – cell phone?	1.7	1.2	15
How do you communicate with your school instructors – in person?	4	0.74	15
How do you communicate with your school instructors – text message?	1	0.77	15
How do you communicate with your school instructors – instant messenger?	1.3	0.8	15
How do you communicate with your school instructors – messages through Facebook/MySpace?	1.1	0.26	15
Please rate your level of agreement with the statements, from 1 to 7, with 1="strongly disagree" to 7="strongly agree".			
...e-mail is one of the best ways to collaborate	4.7	2.1	15
...call on landline is one of the best ways to collaborate	4	2.2	15
...cell phone is one of the best ways to collaborate	5	2.0	15
...in-person is one of the best ways to collaborate	7	0.74	15
...text-messaging is one of the best ways to collaborate	4	2.1	15
...instant messaging is one of the best ways to collaborate	3.5	1.8	15
...messages through Facebook/MySpace is one of the best ways to collaborate	4	2.4	15
...e-mail is how I generally collaborate with class peers.	4.9	1.7	15
...call on landline is how I generally collaborate with class peers	2.3	2.1	15
...cell phone is how I generally collaborate with class peers	5.1	1.8	15
...in-person is how I generally collaborate with class peers	6.7	0.6	15
...text-messaging is how I generally collaborate with class peers	3.7	2.6	15
...instant messaging is how I generally collaborate with class peers	3.8	2.4	14
...messages through Facebook/MySpace is how I generally collaborate with class peers	3.9	2.4	13
Have you ever used a cell phone to access instructional materials?	1.7	0.49	15
Cell phone is a good way to access instructional materials	4	2.1	15
Cell phones are good way to complete homework assignments.	3.3	1.8	15
Cell phones are a good way to communicate with classmates.	6	1.7	15

9. Appendix

A. BotCamp recruitment flyer

An Exciting Summer Opportunity

Learn about nature, botanical science, and the latest web technologies!

Bot 2.0 uses Web 2.0 technologies like facebook, flickr, wikis, and blogs to learn about the botanical world living right outside your door.

Join area college students who will participate in the three-day, expenses paid, BotCamp at UNC-Chapel Hill, along with two hands-on virtual classroom sessions in June and August.

At the BotCamp you will:

- Meet leading researchers and educators in Botanical Science and Information Technology
- Explore behind the scenes at the North Carolina Botanical Garden and UNC's Herbarium.
- Enjoy hands on experience with the latest web technologies at UNC's number one School of Information and Library Science and the Renaissance Computing Institute.

Participants completing the Bot 2.0 course will receive a certificate from the North Carolina Botanical Garden.

Explore this outstanding opportunity to learn about botanical science as a field of study, career, or as a hobby. The program is free and financial assistance is available for any necessary technology needs.

- Better understand the everyday botanical world around you–from your backyard to the grocery store
- Enjoy a three-day, two-night all expenses paid, experience in Chapel Hill at BotCamp
- Learn about and use the latest web and digital technologies for learning and communication
- Make valuable contacts with leading scientists and students at peer institutions
- Improve your knowledge and skills for technologies you use daily—cell phones and social networks
- Explore and have hands-on experiences behind the scenes access to the North Carolina Botanical Garden, Renaissance Computing Institute, and the School of Information and Library Science
- No previous experience or courses in Botany required
- No cost to participate.
- Receive financial assistance for technology needs
- Undergraduates from NCA&T, NCCU, UNC-CH, NCSU, & Alamance CC are encouraged to apply

For more information email dnw@email.unc.edu

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B. Survey question examples

Modes of communication

For the questions on this page, please rate each mode of communication from 1 to 5 in terms of its frequency of use, with 1 being "never" and 5 being "every day"

1. How do you communicate with your friends?

	1 (never)	2	3	4	5 (every day)
Email	○	○	○	○	○
Call on landline phone	○	○	○	○	○
Cell phone	○	○	○	○	○
In-person	○	○	○	○	○
Text message (phone)	○	○	○	○	○
IM	○	○	○	○	○
Messages through Facebook/MySpace	○	○	○	○	○

Modes of collaboration

2. For the following questions, please rate your level of agreement with the statement, from 1 to 7, with 1="strongly disagree" to 7="strongly agree".

Use the words below to complete this statement:
_____ is one of the best ways to collaborate.

	1 "strongly disagree"	2	3	4	5	6	7 "strongly agree"
Email	○	○	○	○	○	○	○
Call on landline phone	○	○	○	○	○	○	○
Cell phone	○	○	○	○	○	○	○
In-person	○	○	○	○	○	○	○
Text message	○	○	○	○	○	○	○
Instant Message (IM)	○	○	○	○	○	○	○
Messages through Facebook/MySpace	○	○	○	○	○	○	○

Educational cell phone use attitudes

5. Please rate your level of agreement with the statements, from 1 to 7, with 1="strongly disagree" to 7="strongly agree".

	1 "strongly disagree"	2	3	4	5	6	7 "strongly agree"
Cell phones are a good way to access instructional materials.	○	○	○	○	○	○	○
Cell phones are good way to complete homework assignments.	○	○	○	○	○	○	○
Cell phones are a good way to communicate with classmates.	○	○	○	○	○	○	○

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